

What is claimed is:

1. A hollow fiber membrane module for filtration, diafiltration dialysis methods, comprising at least one housing and a plurality of tubular hollow fiber membranes which are arranged parallel to one another in and/or around the housing in a packing space, wherein the volumetric ratio of all the hollow fiber membranes arranged in the packing space to the packing space is less than 20%.

2. The hollow fiber membrane module as claimed in claim 1, in which the housing has a cylindrical shape.

3. The hollow fiber membrane module as claimed in claim 1, in which the lateral surface of the housing is provided with openings.

4. The hollow fiber membrane module as claimed in claim 3, in which the openings projected onto a plane are shapes selected from squares, rectangles and circles.

5. The hollow fiber membrane module as claimed in claim 3, in which the openings have dimensions of 3 to 20 mm.

6. The hollow fiber membrane module as claimed in claim 3, in which the ratio of the total surface area of the openings to the total surface area of the housing lateral surface is approximately 0.2 to approximately 0.9.

7. The hollow fiber membrane module as claimed in claim 1, in which the hollow fiber membranes consist of a ceramic and/or polymeric material or comprise the same in substantial proportions.

8. The hollow fiber membrane module as claimed in claim 7, in which the hollow fiber membranes including the support structure have a thickness of approximately 5 μm to approximately 300 μm .

9. The hollow fiber membrane module as claimed in claim 7, in which each of the hollow fiber membranes has an inside diameter of up to 2 mm.

10. The hollow fiber membrane module as claimed in claim 1, in which the hollow fiber membranes are arranged in the module in the form of at least one bundle.

11. The hollow fiber membrane module as claimed in claim 10, in which the hollow fibers are rolled up as bundles in the form of mats with a wide fiber spacing, and the fibers being brought to a spacing adapted to the packing density in the region of the pottings by the wrapping of conventional spacer materials.

12. The hollow fiber membrane module as claimed in claim 10, in which at least two hollow fiber membrane bundles are separated from one another by at least one segmentation element fitted on the lateral surface of the housing.

13. The hollow fiber membrane module as claimed in claim 12, in which the at least one segmentation element comprises a frame part with a free passage surface surrounded by the frame part.

14. The hollow fiber membrane module as claimed in claim 13, in which the free passage surface of the frame part is subdivided by stabilization elements.

15. The hollow fiber membrane module as claimed in claim 14, in which the total surface area of the stabilization elements referred to the free passage surface surrounded by the frame part is approximately 2% to approximately 20%.

16. The hollow fiber membrane module as claimed in claim 13, in which the at least one segmentation element is fitted on the inner surface of the housing and the interior of said housing is subdivided into compartments.

17. The hollow fiber membrane module as claimed in claim 12, in which the at least one segmentation element is fitted on the outer surface of the housing and subdivides the space located over the outer surface of the lateral surface into compartments.

18. The hollow fiber membrane module as claimed in claim 17, in which the housing with the at least one segmentation element fitted on the outer surface of the lateral surface is accommodated in a second cage-like housing.

19. The hollow fiber membrane module as claimed in claim 12, in which the length of at least one segmentation element corresponds to the length of the housing.

20. The hollow fiber membrane module as claimed in claim 12, in which the segmentation elements are shorter than the housing and are distributed over the length of the housing with appropriate axial interspaces, no further segmentation element being arranged inside these axial interspaces over the full azimuth angle inside the housing.

21. The hollow fiber membrane module as claimed in claim 12, in which the segmentation elements are as long as the pottings provided at the ends and are arranged at the end of the housing such that the pottings are segmented.

22. The hollow fiber membrane module as claimed in claim 16, in which hollow fiber membranes are arranged in at least one compartment produced by at least two segmentation elements.

23. The hollow fiber membrane module as claimed in claim 22, in which the hollow fiber membranes arranged in at least one compartment are fixed on at least one segmentation element.

24. The hollow fiber membrane module as claimed in claim 23, in which the packing density of all the hollow fiber membranes is smaller than 20%.

25. The hollow fiber membrane module as claimed in claim 1, which further comprises a housing connection for feeding a liquid into the fiber interior of the hollow fiber membranes and a housing connection for withdrawing a liquid from the fiber interior.

26. The hollow fiber membrane module as claimed in claim 1, in which all the constituents are produced from a material capable of being sterilized with water vapor at 121°C.

27. A method for producing a hollow fiber membrane module, comprising rolling a shaped piece together to produce a housing shape, and arranging the hollow fiber membranes in and/or around the housing in a packing density of less than 20%.

28. The method as claimed in claim 27, wherein the shaped piece is provided with openings.

29. The method as claimed in claim 27, wherein the shaped piece is rolled to produce a cylindrical housing.

30. The method as claimed in claim 27, wherein the shaped piece comprises segmentation elements.

31. The method as claimed in claim 27, in which before or after rolling the shaped piece together, segmentation elements are fitted at spacings on the shaped piece.

32. The method as claimed in claim 30, wherein the shaped piece is rolled together such that the segmentation elements are located on the inner surface of the rolled shaped piece.

33. The method as claimed in claim 31, wherein the shaped piece is rolled together such that the segmentation elements are located on the outer surface of the rolled shaped piece.

34. The method as claimed in claim 27, in which before the shaped piece is rolled together, at least one hollow fiber membrane bundle is arranged and fixed on the shaped piece.

35. The method as claimed in claim 30, in which before the shaped piece is rolled together, at least one hollow fiber membrane bundle is arranged and fixed on the shaped piece in the compartment between two adjacent segmentation elements.

36. The method as claimed in claim 31, in which before the shaped piece is rolled together, at least one hollow fiber membrane bundle is arranged and fixed on the shaped piece in the compartment between two adjacent segmentation elements.

37. The method as claimed in claim 27, in which after the shaped piece has been rolled together, at least one hollow fiber membrane bundle is arranged and fixed in the housing.

38. The method as claimed in claim 30, in which before the shaped piece is rolled together, at least one hollow fiber membrane bundle is arranged and fixed in the housing in the compartment between two adjacent segmentation elements.

39. The method as claimed in claim 31, in which before the shaped piece is rolled together, at least one hollow fiber membrane bundle is arranged and fixed in the housing in the compartment between two adjacent segmentation elements.

40. The method as claimed in claim 27, in which the ends of the hollow fiber membranes are potted, and further comprising sealing the housing at its ends.

41. The method as claimed in one of claim 27, in which the housing is inserted into a second housing.

42. The hollow fiber membrane module as claimed in claim 9, wherein the hollow fiber membranes have an inside diameter of from about 0.15 mm to about 0.8 mm.

43. The hollow fiber membrane module as claimed in claim 11, wherein the bundles comprise less than 10 fibers per centimeter.

44. The hollow fiber membrane module as claimed in claim 17, in which hollow fiber membranes are arranged in at least one compartment produced by at least two segmentation elements.

45. The hollow fiber membrane module as claimed in claim 37, in which the hollow fiber membranes arranged in at least one compartment are fixed on at least one segmentation element.

46. The hollow fiber membrane module as claimed in claim 38, in which the packing density of all the hollow fiber membranes is smaller than 20%.

47. The hollow fiber membrane module as claimed in claim 1, wherein the tubular hollow-fiber membranes have the same or different diameters.